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Crustal Structure across The Southwest Longmenshan Fault Zone from Seismic Wide Angle Reflection/Refraction Profile

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The Lushan eathquake, which epicenter and focal depth were at 30.308° N, 102.888° E, and 14.0 km, is the latest intense earthquake occurring in the southwest section of the Longmenshan fault zone after the Ms 8.0 Wenchuan earthquake in 2008. According to the emergency field observations, the slip distribution of the Lushan earthquake was concentrated at the hypocenter, and did not rupture to the surface(Chen et al, 2013). The rupture history constrained by inverting waveforms showed that the causative fault plane of the Lushan event is apparently not a simple extension of either the Pengguan fault or the Beichuan fault that ruptured during the 2008 Mw 8.0 Wenchuan earthquake. The focal mechanism using the Cut and Paste algorithm showed this event occurred on a high dip-angle fault, but its dip angle is not steep enough to rupture the surface. All these research is not independent on the heterogeneous crust structure of the Longmenshan fault zone. A 450 km-long wide-angle reflection/refraction profile executed during September and October 2013. This experiment have provided the best opportunities to obtain better knowledge of seismic structure and properties of crust and uppermost mantle beneath the Southwest Longmenshan fault zone. This seismic profile extends from the west Sichuan Plain, through the Longmenshan Fault zone, and into the west Sichuan Plateau. We observed clear Pg, refraction Phase from the upper crust, Pi1/Pi2/Pi3, reflection/refraction Phase from intra-crust, PmP, reflection from the Moho boundary, and the Pn phase, refraction Phase from uppermost mantle. We present a hybrid tomographic and layered velocity model of the crust and uppermost mantle along the profile. The final velocity model reveals large variations both in structure and velocity, and is demonstrated that a particular model has minimum structure. The model shows the crustal thickness of the region is very variable. The Moho topography varies more than 10km in the southwest Longmenshan fault zone. In particular, the crust appears the thicken in the western Sichuan plateau, where the crust consists of average thick upper-mid crust and thicker lower crust. We also observe the presence of one low velocity layer or anomalous body in the middle crust in the western Sichuan plateau, which may suggest the general presence of partial melting in the crust. Our model is in favor of models of control of the evolution by lower crustal flow in this region of the southeastern Bayan Har block. Supported by NSFC (grant No. 41104038 and No. 41340007) and state key laboratory open foundation(grant No. SKLGED2013-1-3-E).